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United States Patent [19]

Gedney et al.

[11] **Patent Number:** **5,209,483**[45] **Date of Patent:** **May 11, 1993**[54] **TRANSDUCING AND ANALYZING FORCES FOR INSTRUMENTED SPORTING DEVICES AND THE LIKE**[75] Inventors: **Charles J. Gedney**, Sudbury; **Philip A. Abbot**, Lexington, both of Mass.[73] Assignee: **G&A Associates**, Lexington, Mass.[21] Appl. No.: **687,830**[22] Filed: **Apr. 19, 1991**[51] Int. Cl.⁵ **A63B 69/36**[52] U.S. Cl. **273/187.4; 273/185 R; 273/186.2; 73/862.66; 73/862.04; 73/490; 73/774; 73/862.041; 73/862.628**[58] Field of Search **273/183 R, 183 D, 184 R, 273/185 R, 186 R, 186 A, 193 R; 73/862.04, 862.66, 488, 489, 490, 763, 767, 768, 770, 774**[56] **References Cited****U.S. PATENT DOCUMENTS**

3,438,634	4/1969	Roy .	
3,792,863	2/1974	Evans	273/186 A
4,088,324	5/1978	Farmer	273/186 A
4,094,504	6/1978	Barasch .	
4,138,118	2/1979	Budney .	
4,175,445	11/1979	Templeton, III	73/768
4,523,759	6/1985	Igarashi .	
4,659,090	4/1987	Kustanovich .	
4,759,219	7/1988	Cobb et al. .	
4,802,371	2/1989	Calderara et al.	73/862.04
4,822,042	4/1989	Landsman .	
4,898,389	2/1990	Plutt .	
4,940,236	7/1990	Allen	273/183 D
4,991,850	2/1991	Wilhelm	273/186 A

FOREIGN PATENT DOCUMENTS

WO8404692 12/1984 PCT Int'l Appl. .
 WO8905174 6/1989 PCT Int'l Appl. .

OTHER PUBLICATIONS

"Computer Golf Pro" advertisement for Computer Shot Analyzer, p. 39.

Penwalt Chemicals-Equipment Health Products, Kynar Piezo Film Catalog, Kynar Piezo Film Product Summary and Price List, 1988, and Kynar Piezo Film Technical Manual, 1987, p. 3.

"Golf Day Catalog" advertisement for StrokeMaster, Spring 1991, p. 30.

Sportech Swing Analyzer brochure, Sports Technology, Inc., pp. 1-5.

Bridgestone Science Eye HD-01 brochure, "Handy 01", Bridgestone Sports (U.S.A.) Inc. pp. 1-4.

"Golf Digest" advertisement for The Sharper Image, Dec. 1987, p. 141.

"Golf Digest" advertisement for Club Meter, Oct. 1989, p. 121.

"Golf Digest" advertisement for Accu-Drive, Dec. 1989, p. 186.

"Computer Golf Pro" advertisement for Computer Shot Analyzer, p. 39.

Pennwalt KYNAR Piezo Film catalog; KYNAR Piezo Film Product Summary and Price List, 1988; and KYNAR Piezo Film, Technical Manual, 1987.

Primary Examiner—Jessica J. Harrison

Attorney, Agent, or Firm—Fish & Richardson

[57] **ABSTRACT**

A device that characterizes the trajectory followed by a movable object after a piece of sporting equipment comes into contact with the movable object, e.g., by identifying velocity, the distance that the object would travel if unobstructed in standard ideal conditions, the curvature of the path travelled by the object, the direction of travel of the object, or the direction or magnitude of spin of the object. The device includes at least one force sensor element arranged to be located on the piece of sporting equipment, which is held or worn by a user. The sensor element detects at least a component of the force of contact between the piece of sporting equipment and the movable object. The sensor element provides a signal representing the intensity of the component of the force of contact when the contact occurs. An electrical processing circuit is arranged to receive the signal from the sensor element and to process the signal to produce an output characterizing the trajectory of the movable object. A user notification device is arranged to receive the output from the electrical processing circuit and to present to the user information characterizing the trajectory.

22 Claims, 6 Drawing Sheets